

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-45

Name: Shadehill Reservoir

County: Perkins

Legal description: T 21N, R 15E Sec. 1-4,8-10,15-17,20-23,26,27,34,35

Location from nearest town: 12 miles south of Lemmon, SD

Dates of present survey: May 29-31, August 13-15, 2012

Date last surveyed: June 1-2, August 15-17, 2011

Management classification: Warmwater permanent

Primary Species: (game and forage)

1. Walleye
2. Smallmouth Bass
3. Channel Catfish
4. Black Crappie
5. Yellow Perch
6. Emerald Shiner
7. Gizzard Shad
8. _____

Secondary and other species:

1. Northern Pike
2. Bluegill
3. White Bass
4. Spottail Shiner
5. Common Carp
6. River Carpsucker
7. Northern Redhorse
8. White Sucker

PHYSICAL CHARACTERISTICS

Surface Area: 4,693 acres;

Watershed: 2,176,000 acres

Maximum depth: 62 feet;

Mean depth: 21.8 feet

Lake elevation at survey (from known benchmark): unknown

Ownership of lake and adjacent lakeshore property:

Shadehill Reservoir is, maintained and operated by the United States Bureau of Reclamation. South Dakota Department of Game, Fish and Parks maintains a recreation area/campground and Game Production area along much of the shoreline.

Fishing Access

Shadehill Reservoir has excellent fishing access for shore and boat anglers alike. Shadehill State Park maintains four public boat ramps. Many two-track trails around the lake offer the shore angler good access to the water's edge.

Observations of Water Quality and aquatic vegetation

Due in part to its contour and yearly water level fluctuations, Shadehill Reservoir has limited emergent and submergent vegetation. The lake refilled in 2009 and flooded a ring of vegetation around the lake that was a result of drought during a couple previous years.

Observations on conditions of structures (i.e. spillway, boat ramps and docks, roads, etc)

All access and regulatory structures are in excellent condition. A state park at the reservoir provides excellent facilities for visitors to Shadehill Reservoir.

MANAGEMENT OBJECTIVES

Objective 1. Maintain a Walleye fishery with a minimum gill-net CPUE for stock-length and longer walleye of 15, a PSD range of 30-60, a PSD-P greater than 5, and average growth rate of 35.5 cm (14 in) by age-3.

Objective 2. Maintain the Gizzard Shad population through adult stockings.

BIOLOGICAL DATA

Eight modified fyke (trap) nets and six experimental gill (gill) nets were used to sample the adult fish population (Figure 1). Trap nets consisting of a 1.3 X 1.5 m frame, 19.1 mm (0.75 in) mesh and a 1.2 X 23 m (3.9 X 75.5 ft) lead set May 29-31, 2012 and caught 417 fish (Table 1). Gill nets (45.7 m [150 ft] long and 1.8 m [6 ft] deep with six 7.6 m [25 ft] panels of bar mesh sizes: 12.7 mm [0.5 in], 19.1 mm [0.75 in], mm [1.25 in], 38.1 mm [1.5 in], and 50.8 mm [2.0 in]) were set August 13-15, 2012 caught 298 fish (Table 2). Discussion on selected fish species follows and completes this report.

In addition to the netting survey, day electrofishing was added in 2004 to improve our understanding and sample sizes concerning Gizzard Shad reproduction. Discussion on this and other Gizzard Shad information is included in the Gizzard Shad section of this report.

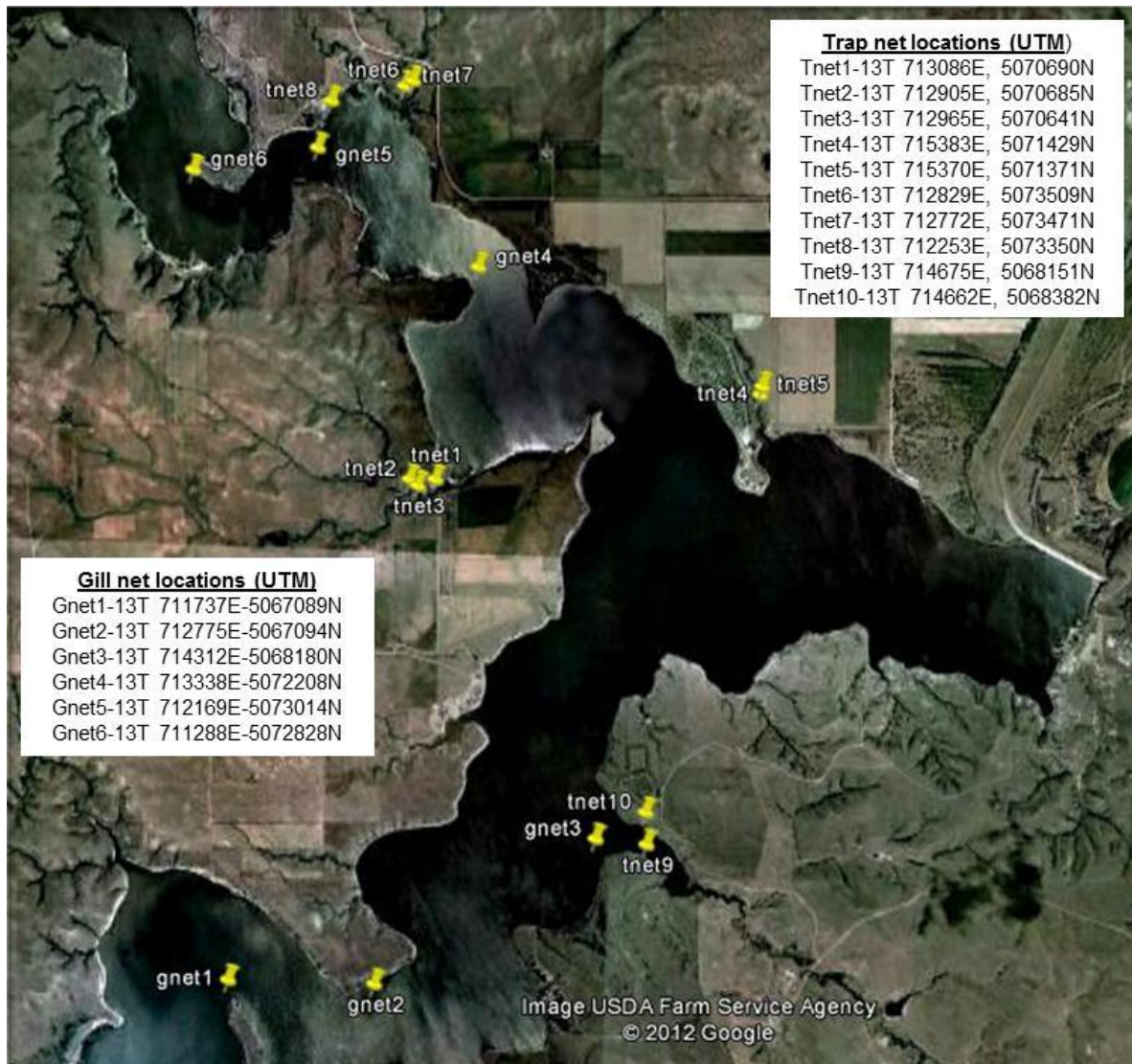


Figure 1. Locations, including GPS coordinates, for modified fyke (tnet) and experimental gill (gnet) nets set during the fisheries survey of Shadehill Reservoir, Perkins County, South Dakota, 2012.

Table 1. Species, number captured (N), catch per unit effort (CPUE), catch per net night of stock-length fish (CPUE-S), proportional stock density (PSD) , proportional stock density of preferred-length fish (PSD-P) and relative weight of stock length or greater fish ($Wr>S$) from all fish species collected in eight modified fyke nets in Shadehill Reservoir, Perkins County, South Dakota, May 29-31, 2012. CPUE values with 80% confidence intervals in parentheses, PSD, PSD-P and $Wr>S$ values with 90% confidence intervals in parentheses.

Species	N	CPUE	CPUE-S	PSD	PSD-P	$Wr>S$
Black Crappie	357	44.6 (18.9)	44.6 (18.9)	97 (2)	12 (3)	108.6 (1.0)
Bluegill	14	1.8 (1.4)	1.8 (1.4)	29 (23)	0	117.5 (1.7)
Common Carp	1	0.1 (0.2)	0.1 (0.2)	--	--	98.5 (--)
Green Sunfish	1	0.1 (0.2)	0.1 (0.2)	--	--	105.3 (--)
Smallmouth Bass	7	0.9 (0.4)	0.9 (0.4)	14 (28)	0	92.6 (5.9)
White Crappie	33	4.1 (1.8)	4.1 (1.8)	100	91 (9)	103.4 (0.9)
White Sucker	1	0.1 (0.2)	0.1 (0.2)	--	--	91.3 (--)
Yellow Perch	3	0.4 (0.3)	0.4 (0.3)	--	--	99.0 (--)
Totals	417					

Table 2. Species, number captured (N), catch per unit effort (CPUE), catch per net night of stock-length fish (CPUE-S), proportional stock density (PSD) , proportional stock density of preferred-length fish (PSD-P) and relative weight of stock length or greater fish ($Wr>S$) from all fish species collected in six experimental gill nets in Shadehill Reservoir, Perkins County, South Dakota, August 13-15, 2012. CPUE values with 80% confidence intervals in parentheses, PSD, PSD-P and $Wr>S$ values with 90% confidence intervals in parentheses.

Species	N	CPUE	CPUE-S	PSD	PSD-P	$Wr>S$
Black Crappie	8	1.3 (0.5)	1.3 (0.5)	100	13 (23)	100.4 (3.3)
Channel Catfish	128	21.3 (5.8)	19.0 (4.0)	56 (8)	0	84.7 (0.7)
Common Carp	8	1.3 (0.5)	1.3 (0.5)	25 (31)	13 (23)	90.3 (5.6)
Freshwater Drum	6	1.0 (0.9)	1.0 (0.9)	--	--	99.8 (8.4)
Gizzard Shad	14	2.3 (1.2)	2.3 (1.2)	0	0	87.3 (10.4)
Goldeye	1	0.2 (0.2)	--	--	--	--
Northern Pike	5	0.8 (0.5)	0.8 (0.5)	60 (52)	20 (43)	90.4 (8.5)
River Carpsucker	4	0.7 (0.5)	0.7 (0.5)	--	--	98.2 (29.3)
Shorthead Redhorse	2	0.3 (0.3)	0.3 (0.3)	--	--	88.6 (--)
Walleye	86	14.3 (8.4)	14.2 (8.4)	6 (4)	1 (2)	77.4 (0.5)
White Bass	4	0.7 (0.5)	0.7 (0.5)	--	--	85.5 (0.0)
White Crappie	20	3.3 (1.9)	3.3 (1.9)	100	20 (16)	98.8 (1.6)
Yellow Perch	12	2.0 (1.1)	2.0 (1.1)	58 (27)	0	90.5 (4.4)
Totals	298					

Black Crappie

Trap net sampling was moved to the spring to more effectively sample the Black Crappie population. In 2012, catch per unit effort (CPUE) was 44.6 with a proportional stock density (PSD) of 97 and a proportional stock density of preferred-length fish (PSD-P) of 12. In 2011, CPUE was 6.9, however, stock densities were similar to the 2011 sample with a PSD of 97 and a PSD-P of 41 in 2012 (Table 3). Fish condition was high with a mean relative weight for stock length and larger fish ($W_{r>S}$) of 108.6. Length frequency histograms indicate a large portion of the population between 200 and 230 mm (Figure 2).

Table 3. Species, number captured (N), , catch per unit effort (CPUE), catch per net night of stock-length fish (CPUE-S), proportional stock density (PSD) , proportional stock density of preferred-length fish (PSD-P) and relative weight of stock length or greater fish ($W_{r>S}$) for Black Crappie collected by modified fyke nets in Shadehill Reservoir, Perkins County, South Dakota, 2006-2012. CPUE values with 80% confidence intervals in parentheses. PSD, PSD-P and $W_{r>S}$ values with 90% confidence intervals in parentheses.

Year	N	CPUE	PSD	PSD-P	$W_{r>S}$
2006	11	1.4 (0.7)	83 (33)	67 (43)	91.8 (3.1)
2007	12	1.5 (0.9)	73 (26)	18 (22)	92.9 (2.6)
2008	5	0.6 (0.3)	40 (52)	0	95.1 (3.6)
2009	14	2.0 (1.0)	93 (13)	57 (24)	102.3 (4.2)
2010	49	6.1 (2.3)	31 (12)	16 (9)	106.7 (1.9)
2011*	69	6.9 (6.6)	97 (3)	41 (10)	106.9 (1.9)
2012*	357	44.6 (18.9)	97 (2)	12 (3)	108.6 (1.0)

*spring trap net sample

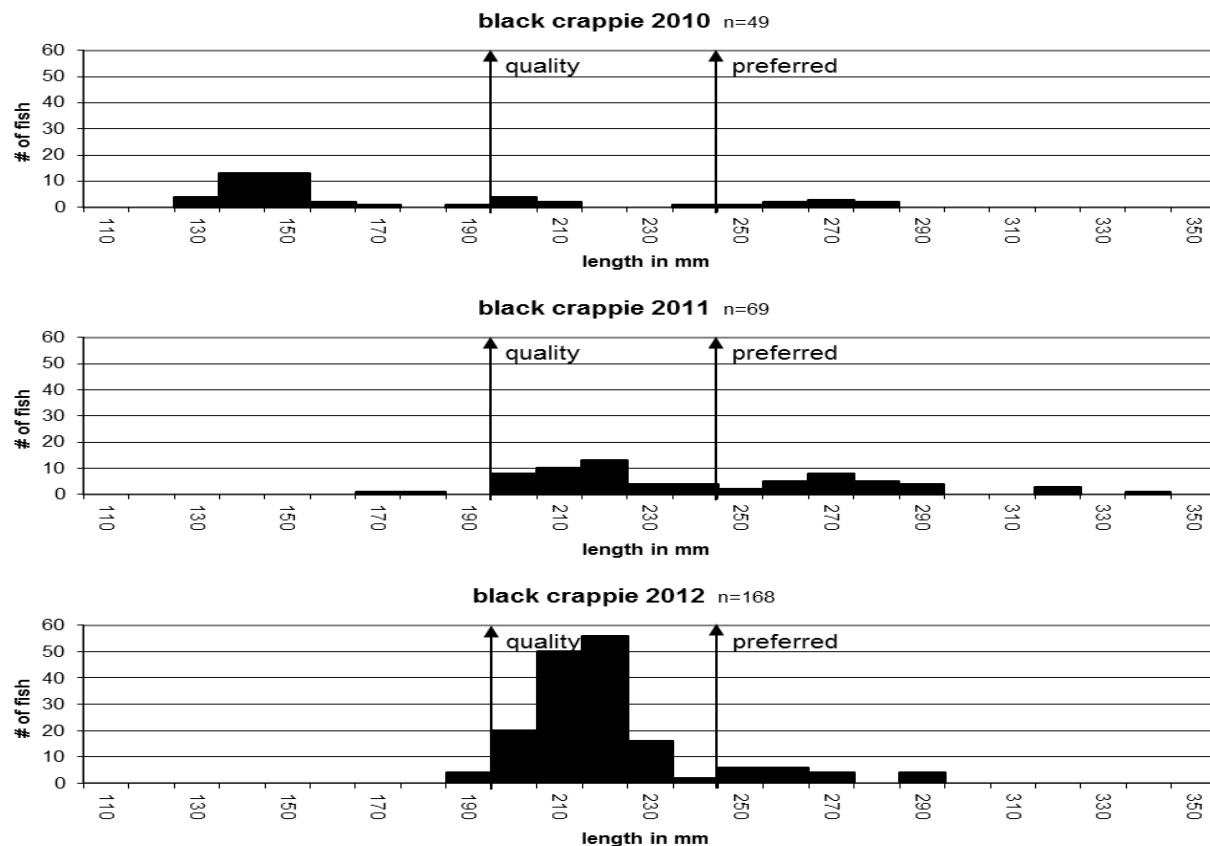


Figure 2. Length frequency histograms for Black Crappie sampled in modified fyke nets in Shadehill Reservoir, Perkins County, South Dakota, 2010-2012.

Channel Catfish

Channel Catfish numbers remain stable with a gill net CPUE of 21.3 compared to 22.8 in 2011 (Table 4). Size structure also remained similar with a PSD of 56 this year, 71 last year and 67 in 2010. Proportional stock density of preferred-length fish (PSD-P) has been 0 or 1 for the last six years. Very few of these abundant Channel Catfish ever reach larger preferred sizes, possibly our gear does not sample the larger fish (Figure 3). Fish $Wr>S$ was low at 84.7, down from 88.8 in 2011.

Table 4. Species, number captured (N), catch per unit effort (CPUE and CPUE-S), proportional stock densities (PSD and PSD-P) and relative weight of stock length or greater fish ($Wr>S$) for channel catfish collected by gill nets in Shadehill Reservoir, Perkins County, South Dakota, 2006-2012. CPUE values with 80% confidence intervals in parentheses. PSD, PSD-P and $Wr>S$ values with 90% confidence intervals in parentheses.

Year	N	CPUE	PSD	PSD-P	$Wr>S$
2006	199	24.9 (6.6)	36 (6)	0	78.9 (0.7)
2007	116	19.3 (4.0)	38 (8)	1 (1)	76.5 (0.7)
2008	196	32.7 (9.7)	26 (5)	1 (--)	75.1 (0.8)
2009	29	4.8 (1.4)	41 (16)	0	97.1 (3.5)
2010	81	13.5 (4.9)	67 (9)	0	82.6 (0.2)
2011	137	22.8 (7.9)	71 (7)	1 (1)	88.8 (3.4)
2012	128	21.3 (5.8)	56 (8)	0	84.7 (0.7)

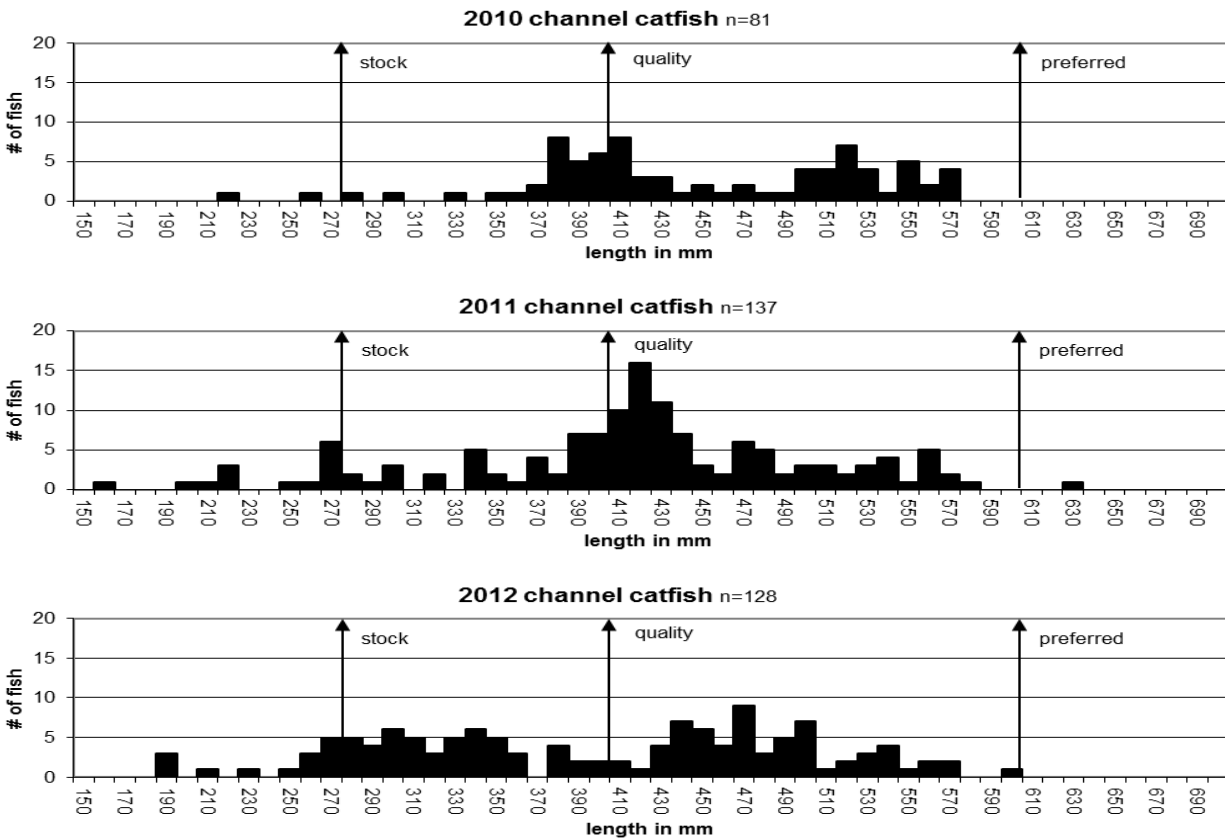


Figure 3. Length frequency histograms for Channel Catfish sampled in experimental gill nets in Shadehill Reservoir, Perkins County, South Dakota, 2010-2012.

Gizzard Shad

Age-0 Gizzard Shad numbers remained strong with an electrofishing CPUE of 214 per hour (Figure 4), with seven of the nine sites producing fish (Table 5). No adults were stocked in 2012. Some of the 2011 year class survived the winter as the gill nets sampled fourteen age-1 gizzard shad (Figure 5). These are the first Gizzard Shad older than age-0 sampled in gill nets since 2008.

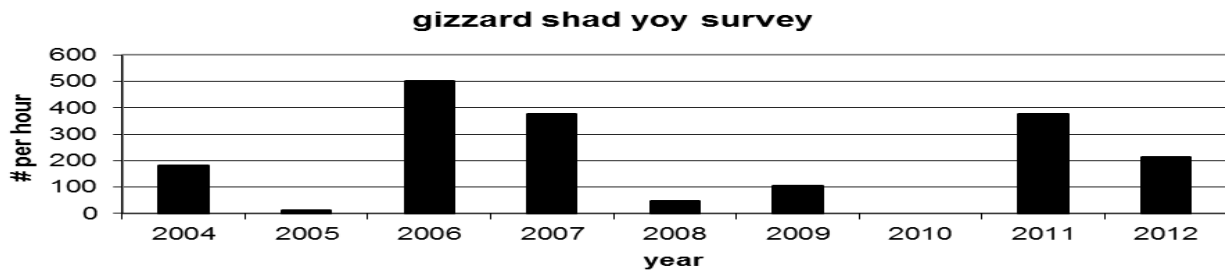


Figure 4. Number of age-0 Gizzard Shad caught per hour during daytime boat electrofishing surveys from Shadehill Reservoir, Perkins county, South Dakota, 2004-2012.

Table 5. Site, number caught per site (#/site), time (seconds) and number per hour (#/hr) for age-0 Gizzard Shad sampled during the daytime boat electrofishing survey results at Shadehill Reservoir, Perkins County, South Dakota, August 13, 2012.

Site	#/Site	Time (sec)	#/hr
Lower #1	0	600	0
Middle #1	1	600	6
Middle #2	1	300	12
Middle #3	102	300	1224
S. Upper #1	7	300	84
S. Upper #2	2	300	24
S. Upper #3	0	600	0
N. Upper #1	62	300	744
N. Upper #2	39	300	468
Total	214	1.0 hrs	214

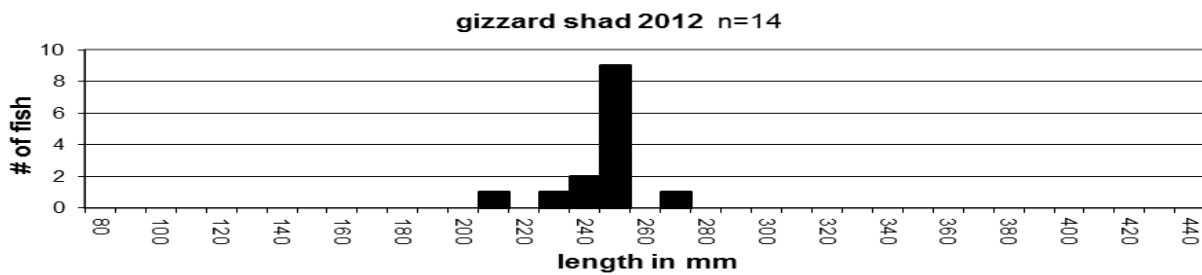


Figure 5. Length frequency histogram for Gizzard Shad sampled in experimental gill nets at Shadehill Reservoir, Perkins County, South Dakota, August 13-15, 2012.

Walleye

Walleye showed a slight increase in abundance compared to 2011's sample. Gill net CPUE was 14.3, compared to 13.7 in 2011 (Table 6). Catch for stock length and larger fish also showed an increase with CPUE going from 11.5 to 14.2, getting closer to the management goal of a CPUE of 15. Size structure, however, was poor with a PSD of 6. Length frequencies also show most of the sampled Walleye were less than 15 inches (Figure 6). Age data indicated that age-3 Walleye averaged roughly 13 inches (Table 7). These fish should provide good catch and harvest next year as they grow past the 15 inch minimum. Walleye condition was poor with a mean $Wr > S$ of 77.4, which decreased from a mean of 83.2 in 2011.

Table 6. Species, number captured (N), catch per unit effort (CPUE), catch per unit effort of stock-length fish (CPUE-S), proportional stock density (PSD) , proportional stock density of preferred-length fish (PSD-P) and relative weight of stock length or greater fish ($W_{r>S}$) for Walleye collected by experimental gill nets in Shadehill Reservoir, Perkins County, South Dakota, 2006-2012. CPUE's with 80% confidence intervals in parentheses. PSD, PSD-P and $W_{r>S}$ with 90% confidence intervals in parentheses.

Year	N	CPUE	CPUE-S	PSD	PSD-P	$W_{r>S}$
2006	57	7.1 (1.8)	6.1 (1.7)	27(10)	4 (5)	84.0 (1.0)
2007	56	9.3 (2.8)	8.2 (3.1)	33 (12)	2 (3)	80.1 (0.8)
2008	57	9.5 (3.0)	7.5 (2.3)	27 (11)	2 (4)	81.9 (0.7)
2009	100	16.7 (8.3)	13.5 (6.7)	19 (8)	1 (2)	86.0 (0.1)
2010	64	10.7 (3.1)	5.8 (1.7)	34 (14)	0	80.9 (0.7)
2011	82	13.7 (4.8)	11.5 (4.0)	20 (8)	0	83.2 (2.7)
2012	86	14.3 (8.4)	14.2 (8.4)	6 (4)	1 (2)	77.4 (0.5)

Table 7. Age, minimum, maximum and weighted mean lengths (mm) at capture by age (determined from otoliths) for Walleye sampled in experimental gill nets in Shadehill Reservoir, Perkins County, South Dakota, August 13-15, 2012.

Age	Minimum length @ capture	Weighted mean length @ capture	Maximum length @ capture	Number of fish in survey
2	244	287	330	8
3	251	325	389	75
5	556	556	556	1

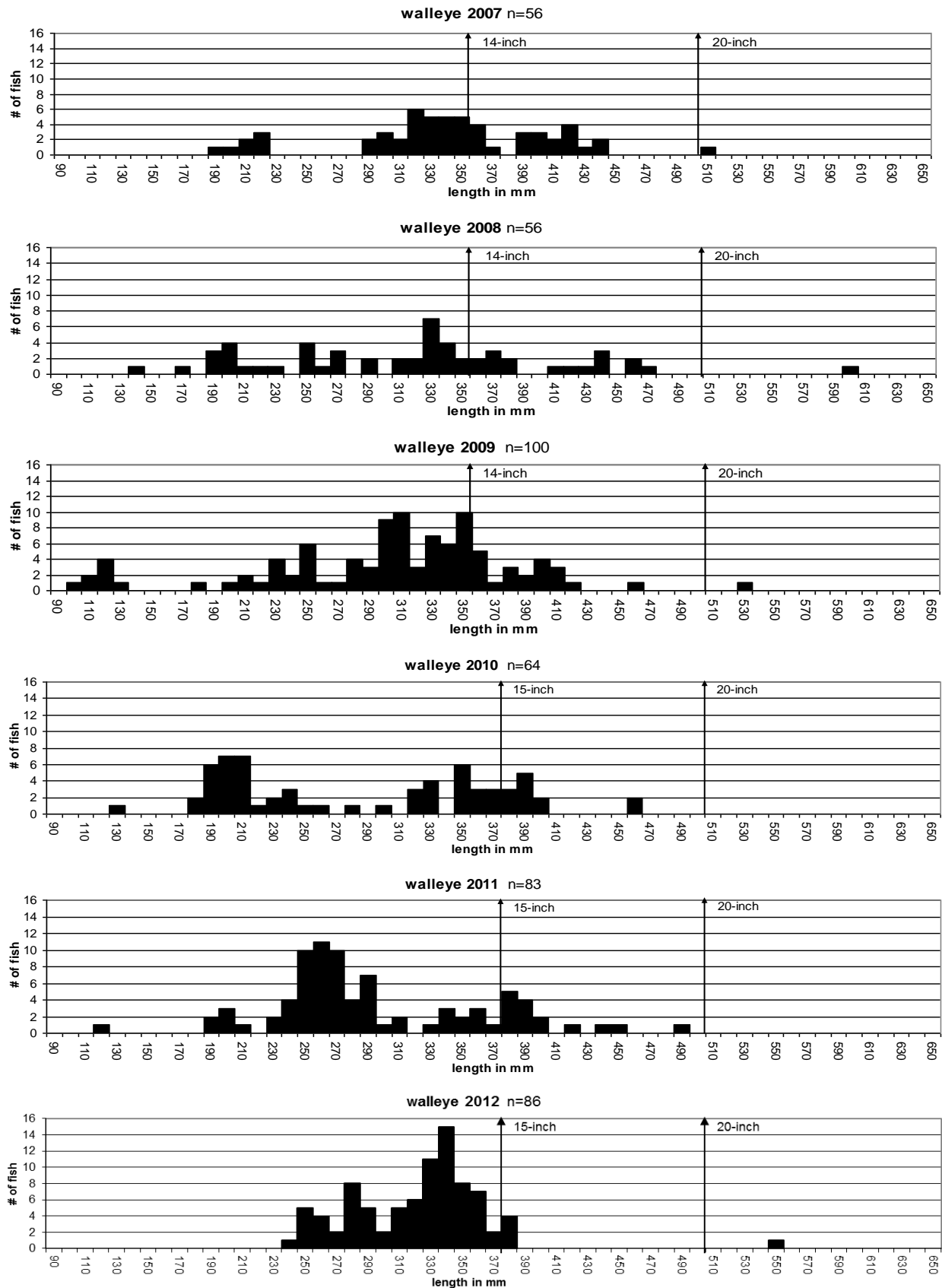


Figure 6. Length frequency histograms for Walleye collected in experimental gill nets from Shadehill Reservoir, Perkins County, South Dakota, 2007-2012.

White Bass

White Bass abundance has declined steadily since 2010, with gill net catch per unit effort of stock-length fish (CPUE-S) falling to 0.7 in 2012 (Table 8). Fish condition was also lower than last year with $Wr>S$ at 85.5, compared to 90.7 in 2011.

Table 8. Species, number captured (N), catch per unit effort (CPUE), catch per unit effort of stock-length fish (CPUE-S), proportional stock density (PSD), proportional stock density of preferred-length fish (PSD-P) and relative weight of stock length or greater fish ($Wr>S$) for White Bass collected in experimental gill nets in Shadehill Reservoir, Perkins County, South Dakota, 2006-2012. CPUE values with 80% confidence intervals in parentheses. PSD, PSD-P and $Wr>S$ values with 90% confidence intervals in parentheses.

Year	N	CPUE	CPUE-S	PSD	PSD-P	$Wr>S$
2006	85	10.6 (5.8)	10.6 (5.8)	99 (2)	9 (6)	84.3 (0.2)
2007	73	12.2 (7.1)	12.2 (7.1)	100	18 (8)	81.5 (0.1)
2008	53	8.8 (5.0)	8.8 (5.0)	96 (4)	30 (11)	82.1 (1.0)
2009	47	7.8 (3.7)	5.3 (3.8)	100	69 (14)	92.1 (0.8)
2010	69	11.5 (5.0)	11.5 (5.0)	74 (9)	68 (9)	90.4 (0.2)
2011	49	8.2 (5.1)	8.0 (5.1)	92 (7)	50 (12)	90.7 (0.7)
2012	4	0.7 (0.5)	0.7 (0.5)	--	--	85.5 (0.0)

White Crappie

White Crappie abundance was low with a CPUE of 4.1. Stock indices, however, were very high with a PSD of 100 and a PSD-P of 91. Condition was also high with an average $Wr>S$ at 103.4. The length frequency histogram indicates a large size structure with a proportion of individuals over reaching over memorable length (Figure 7).

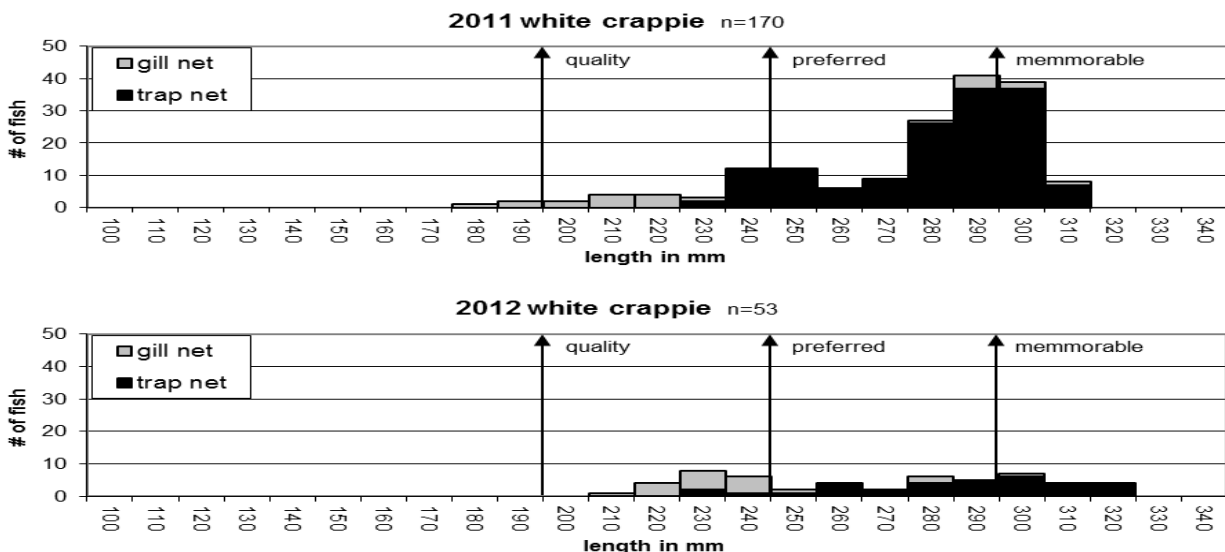


Figure 7. Length frequency histograms of White Crappie collected by experimental gill (gill net) nets and modified fyke (trap net) nets in Shadehill Reservoir, Perkins County, South Dakota, 2011-2012.

RECOMMENDATIONS

1. Continue conducting annual surveys of the fishery to evaluate populations and stocking success (i.e. Gizzard Shad introductions, Walleye, and Smallmouth Bass).
2. Stock adult pre-spawn Gizzard Shad annually to potentially increase forage for Walleye and other predatory fish.

APPENDIX

Appendix A. Stocking history, including year, number stocked, species and size of stocking within Shadehill Reservoir, Perkins County, South Dakota, 2002-2012.

Year	Number	Species	Size
2002	50,000	Walleye	Fingerlings
2003	251	Gizzard Shad	Adult
2004	233 162,700	Gizzard Shad Walleye	Adult Fingerlings
2005	250 200,300	Gizzard Shad Walleye	Adult Fingerlings
2006	65 166,698	Gizzard Shad Walleye	Adult Fingerlings
2007	192,953	Walleye	Fingerlings
2008	409,235	Walleye	Fingerlings
2009	420,652 85	Walleye Gizzard Shad	Fingerlings Adult
2010	90 385,829	Gizzard Shad Walleye	Adult Fingerlings
2011	225 278,922	Gizzard Shad Walleye	Adult Fingerlings
2012	6,000,000 28,832 30,173	Walleye Rainbow Trout Smallmouth Bass	Fry Fingerlings Fingerlings

